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Nitrate leaching from sandy forest soils with stands differing in tree species

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For soils under forest use, management practice including the choice of tree species has a significant influence on the quantity and quality of infiltrating rainfall, altering surface runoff, water retention and quality of drinking water. Decay of organic material from litter fall can result in the production and redistribution of potential toxic, or at least problematic, chemical substances, e.g. nitrate (NO_3^-). Thus, the choice of tree species together with climatic, soil properties, and management practices play an important role on the redistribution of such substances in the soil and eventually to the ground water.

From 2003 to 2005, investigations were carried out on five forest plots within a drinking water protection area in northwestern Jutland, Denmark. The study area is situated just 2 km off the coast to the North Sea. Deposition of N and non-seasalt S are small. The predominant soil types in the study area are Cambisols and Podsols from Aeolian deposits, exhibiting mottling due to temporary or stagnant water logging. The forest stands investigated represent different kinds of forest plantations and are dominated by pure even aged populations of Sitka spruce (*Picea sitchensis*), European beech (*Fagus sylvatica*), European silver fir (*Abies alba*) and Black mountain pine (*Pinus uncinata*), respectively.

Soil samples from drilling with a hand auger at different soil depths (0–100 cm) were used for the experiments. On the samples, analyses were performed with respect to texture, soil organic matter content, pH, and nitrate content. Additionally, ground penetrating radar was used to reveal the depth of the water table and other subsurface properties.

The results indicate that forest structure and tree age are amongst the variables influ-

encing the amount of produced problematic substances through quantity and quality of the produced litter. Consequently, the production and supply of potential toxic substances varies according to the stand structure of the investigated plots. Nitrate concentrations varied between 4.3 and 17.8 mg N l, while $pH_{(KCl)}$ varied between 4 and 6.3. Content of organic C was low for all plots and depths, varying between 0.15 and 2.6 %. For the lower lying plots (three of four), ground penetrating radar revealed a groundwater table approx. 1.3 and 2.3 m below soil surface.

All plots show elevated amounts of nitrate in the seepage water, temporarily (event driven) exceeding the EU drinking water standard. It is concluded that nitrate leaching at this site at present constitutes no danger to drinking water but that the system's capability of buffering NH_4 and related substances is well exceeded when a threshold of 2 mg N l for natural leaching is applied, and that management practices have to be evaluated consequently.